WHAT IS CLAIMED IS:

1. A method of growing an AlGaN single crystal boule, the method comprising the steps of:

growing an AlGaN single crystal layer on a substrate;

removing said substrate from said AlGaN single crystal layer;

growing the AlGaN single crystal boule on a surface of said AlGaN single crystal layer; and

continuing said step of growing the AlGaN single crystal boule until the AlGaN single crystal boule has a length of greater than 1 centimeter.

2. The method of claim 1, wherein said step of growing said AlGaN single crystal layer on said substrate further comprises the steps of:

locating an extended Ga source within a first source zone of a reactor;

locating said substrate within a growth zone of said reactor;

locating an Al source within a second source zone of said reactor;

heating said substrate to a first temperature, wherein said first temperature is greater than 1,000 °C;

heating a first portion of said extended Ga source to a second temperature, wherein said second temperature is greater than 450 °C;

maintaining a second portion of said extended Ga source at a third temperature, wherein said third temperature is greater than 30 °C, and wherein said third temperature is less than 100 °C;

heating said Al source to a fourth temperature, wherein said fourth temperature is greater than 700 °C;

introducing a halide reaction gas into said first source zone to form a first halide metal compound;

introducing said halide reaction gas into said second source zone to form a second halide metal compound;

transporting said first halide metal compound to said growth zone;

transporting said second halide metal compound to said growth zone;

introducing a reaction gas into said growth zone, said reaction gas containing nitrogen; and

growing said AlGaN single crystal layer on said substrate, said AlGaN single crystal layer formed by said reaction gas reacting with said first halide metal compound and said second halide metal compound.

3. The method of claim 2, further comprising the step of selecting HCl gas as said halide reaction gas, wherein said first halide metal compound is comprised of gallium chloride, and wherein said second halide metal compound is comprised of aluminum trichloride.

4. The method of claim 2, further comprising the step of selecting ammonia gas as said reaction gas.

5. The method of claim 2, further comprising the step of selecting said second temperature as approximately 650 °C.

6. The method of claim 2, wherein said step of transporting said first halide metal compound to said growth zone is further comprised of the step of flowing an inert gas through said first source zone, and wherein said step of transporting said second halide metal compound to said growth zone is further comprised of the step of flowing said inert gas through said second source zone.

7. The method of claim 2, further comprising the steps of:

locating at least one acceptor impurity metal in a third source zone of said reactor;

heating said at least one acceptor impurity metal to a fifth temperature; and

transporting said at least one acceptor impurity metal to said growth zone, wherein said AlGaN single crystal layer contains said at least one acceptor impurity metal.

8. The method of claim 2, further comprising the steps of:

locating at least one donor in a third source zone of said reactor;

heating said at least one donor to a fifth temperature; and

transporting said at least one donor to said growth zone, wherein said AlGaN single crystal layer contains said at least one donor.

9. The method of claim 2, further comprising the steps of:

locating a second Al source within a third source zone of said reactor;

heating said second Al source to a fifth temperature, wherein said fifth temperature is greater than 700 °C;

introducing said halide reaction gas into said third source zone to form said second halide metal compound;

transporting said second halide metal compound from said third source zone to said growth zone;

discontinuing said step of transporting said second halide metal compound from said second source zone to said growth zone; and

discontinuing said step of introducing said halide reaction gas into said second source zone.

10. The method of claim 1, wherein said step of removing said at least one substrate from said AlGaN single crystal layer further comprises the steps of:

slicing a wafer from said AlGaN single crystal layer; and

polishing said surface of said wafer.

11. The method of claim 10, further comprising the step of etching said polished surface.

12. The method of claim 1, wherein said step of removing said substrate from said AlGaN single crystal layer further comprises the step of etching said substrate from said AlGaN single crystal layer to expose said surface of said AlGaN single crystal layer.

13. The method of claim 12, wherein said etching step further comprises the step of placing said substrate with said AlGaN single crystal layer into a crucible containing molten KOH.

14. The method of claim 13, further comprising the step of reactive ion etching said exposed surface, said reactive ion etching step proceeding after the step of removing said substrate from said crucible of molten KOH.

15. The method of claim 12, further comprising the step of polishing said exposed surface.

16. The method of claim 15, further comprising the step of reactive ion etching said polished, exposed surface.

17. The method of claim 15, further comprising the step of chemically etching said polished, exposed surface.

18. The method of claim 1, wherein said step of removing said at least one substrate from said AlGaN single crystal layer further comprises the steps of:

polishing said substrate, wherein a first portion of said substrate is removed from said AlGaN single crystal layer through said polishing step; and

reactive ion etching said substrate, wherein a second portion of said substrate is removed from said AlGaN single crystal layer through said reactive ion etching step.

19. The method of claim 18, wherein said reactive ion etching step uses an Si_3F/Ar mixture.

20. The method of claim 1, wherein said step of growing the AlGaN single crystal boule on said surface of said AlGaN single crystal layer further comprises the steps of:

locating an extended Ga source within a first source zone of a reactor;

locating said AlGaN single crystal layer within a growth zone of said reactor;

locating an Al source within a second source zone of said reactor;

heating said AlGaN single crystal layer to a first temperature, wherein said first temperature is greater than 1,000 °C;

heating a first portion of said extended Ga source to a second temperature, wherein said second temperature is greater than 450 °C;

maintaining a second portion of said extended Ga source at a third temperature, wherein said third temperature is greater than 30 °C, and wherein said third temperature is less than 100 °C;

heating said Al source to a fourth temperature, wherein said fourth temperature is greater than 700 °C;

introducing a halide reaction gas into said first source zone to form a halide metal compound;

introducing said halide reaction gas into said second source zone to form a second halide metal compound;

transporting said first halide metal compound to said growth zone;

transporting said second halide metal compound to said growth zone;

introducing a reaction gas into said growth zone, said reaction gas containing nitrogen;

growing a first portion of the AlGaN single crystal boule on said AlGaN single crystal layer, said first portion of the AlGaN single crystal boule formed by said reaction gas reacting with said first halide metal compound and said second halide metal compound;

continuing said growing step for at least 10 minutes;

heating said AlGaN single crystal layer to a fifth temperature, wherein said fifth temperature is greater than 850 °C and less than 1,000 °C;

growing a second portion of the AlGaN single crystal boule, said second portion of the AlGaN single crystal boule formed by said reaction gas reacting with said first halide metal compound and said second halide metal compound; and

continuing said step of growing said second portion of the AlGaN single crystal boule for at least 12 hours.

21. The method of claim 20, wherein said step of transporting said first halide metal compound to said growth zone is further comprised of the step of flowing an inert gas through said first source zone, and wherein said step of transporting said second halide metal compound to said growth zone is further comprised of the step of flowing said inert gas through said second source zone.

22. The method of claim 20, further comprising the step of selecting HCl gas as said halide reaction gas, wherein said first halide metal compound is comprised of gallium chloride, and wherein said second halide metal compound is comprised of aluminum trichloride.

23. The method of claim 20, further comprising the step of selecting ammonia gas as said reaction gas.

24. The method of claim 20, further comprising the step of selecting said second temperature as approximately 650 °C.

25. The method of claim 20, further comprising the steps of:

locating at least one acceptor impurity metal in a third source zone of said reactor;

heating said at least one acceptor impurity metal to a sixth temperature; and

transporting said at least one acceptor impurity metal to said growth zone, wherein said AlGaN single crystal boule contains said at least one acceptor impurity metal.

26. The method of claim 20, further comprising the steps of:

locating at least one donor in a third source zone of said reactor;

heating said at least one donor to a sixth temperature; and

transporting said at least one donor to said growth zone, wherein said AlGaN single crystal boule contains said at least one donor.

27. The method of claim 20, further comprising the steps of:

locating a second Al source within a third source zone of said reactor;

heating said second Al source to a sixth temperature, wherein said sixth temperature is greater than 700 °C;

introducing said halide reaction gas into said third source zone to form said second halide metal compound;

transporting said second halide metal compound from said third source zone to said growth zone;

discontinuing said step of transporting said second halide metal compound from said second source zone to said growth zone; and

discontinuing said step of introducing said halide reaction gas into said second source zone.

28. A method of growing an AlGaN single crystal boule, the method comprising the steps of:

growing an AlGaN single crystal layer on a substrate;

removing said substrate from said AlGaN single crystal layer;

growing the AlGaN single crystal boule on a surface of said AlGaN single crystal layer utilizing a modified HVPE process and an extended, multi-temperature zone Ga source; and

continuing said step of growing the AlGaN single crystal boule until the AlGaN single crystal boule has a volume in excess of 4 cubic centimeters, and wherein an *x*, a *y*, and a *z* dimension of said AlGaN single crystal boule each exceed 1 centimeter.